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A revision of the marine eel-tailed catfish genus *Euristhmus* (Teleostei: Siluriformes: Plotosidae)

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ABSTRACT

The Indo-west Pacific plotosid catfish genus *Euristhmus* Ogilby is revised and found to include five species: *E. lepturus* (Günther) occurs along the eastern and northern parts of Australia, from Sydney to the Gulf of Carpentaria; *E. microceps* (Richardson) is reported from Shark Bay, Western Australia to Goulburn Islands, Northern Territory; and *E. nudiceps* (Günther), the most widely distributed species, extends along the northern margin of Australia, from Exmouth Bay, Western Australia to Moreton Bay, Queensland. Two new species are described herein: *E. microphthalmus*, from coastal regions of the Northern Territory, Australia and West Papua, Indonesia; and *E. sandrae* from the vicinity of Rowley Shoals and Exmouth Gulf, Western Australia. *Exilichthys* Whitley is a junior synonym of *Euristhmus*; *Cnidoglanis microcephalus* Günther is an unnecessary replacement name for *E. microceps*; and *Plotosus elongatus* Castelnau is a junior subjective synonym of *E. lepturus*. A lectotype is designated for *Cnidoglanis lepturus* Günther.

KEYWORDS: eel-tailed catfishes, Plotosidae, *Euristhmus*, Indo-Wwest Pacific, taxonomy, new species.

INTRODUCTION

Eel-tailed catfishes (Siluriformes: Plotosidae) comprise a group of Indo-west Pacific freshwater and marine catfishes with elongate bodies that taper posteriorly and a continuous median fin that is supported by rays of the anal and caudal fins, and procurrent caudal-fin rays (Ferraris 2001). Marine eel-tailed catfishes possess a dendritic organ protruding from behind the anus that apparently functions as a salt regulatory organ (Burgess 1989) and the fin spines are sharp-pointed and supported by venom-producing epidermal tissue that causes extremely painful wounds to careless handlers of these fishes. Four genera of marine plotosids are currently recognised (i.e., *Cnidoglanis*, *Euristhmus*, *Paraplotosus*, and *Plotosus*), however, no comprehensive systematic treatment of marine plotosids is available. Species of the marine plotosid genus *Plotosus* are widely distributed in the Indo-west Pacific region, while the other three genera are restricted to the Australia-New Guinea region and parts of the Malay Peninsula.

Recent authors have treated the taxonomy of marine Plotosidae in various ways. Burgess (1989) summarised the taxonomy of the marine and freshwater species and included a key to the genera. Paxton *et al.* (1989) listed valid genera and species, with their synonyms, of all Australian plotosids. Ferraris (2001) provided a key to genera and species of marine plotosids found in the tropical western Pacific.

Euristhmus is possibly the most poorly understood of the marine plotosid genera. *Euristhmus* was erected by Ogilby (1899) for *Plotosus elongatus* (Castelnau, 1878) and *Cnidoglanis lepturus* (Günther, 1864). Although he provided a description of *Euristhmus*, Ogilby (1899) did not distinguish his new genus from either *Cnidoglanis* or *Plotosus*, so it is unclear why *Euristhmus* was erected or delimited except by inference from the derivation of the genus name (Greek for 'wide isthmus'). A wide, versus narrow, isthmus was the only character McCulloch (1921) used to separate *Euristhmus* from *Plotosus* and *Cnidoglanis*. In his key to the family Plotosidae, McCulloch (1921) stated that the gill membranes were narrowly united with the isthmus in *Cnidoglanis* and *Plotosus*, whereas in *Euristhmus* the gill membranes were separated by a wide isthmus.

The use of *Euristhmus* as a valid genus has been sporadic and has only gained wide acceptance recently. In most earlier publications, the species that Paxton *et al.* (1989) placed in *Euristhmus* were all considered as part of *Cnidoglanis*. Neither Weber and De Beaufort (1913) nor Taylor (1964) recognised *Euristhmus*. Grant (1978) was one of the few workers to recognise *Euristhmus* subsequent to McCulloch (1921). That author provided a

colour photograph, a drawing, and a descriptive account of the morphology and ecology of *E. lepturus*. Gloerfelt-Tarp and Kailola (1984) provided colour photographs and short descriptions of *E. lepturus* (Günther) and *E. nudiceps* (Günther). Burgess (1989) and Paxton *et al.* (1989) recognised three species of *Euristhmus* – *E. lepturus, E. nudiceps* and *E. microceps* (Richardson) – and synonymised *Plotosus elongatus* Castelnau with *Euristhmus lepturus*. Burgess (1989) also provided a key to the species of Plotosidae.

Whitley (1933) erected the new genus *Exilichthys* for *Cnidoglanis nudiceps* Günther. In describing his new genus, Whitley stated: "Occipital region osseous, not covered with loose skin. Head small, depressed, with gill membranes not united across isthmus." *Exilichthys* was listed as a synonym of *Cnidoglanis* by Burgess (1989), but was not mentioned in either Taylor (1964) or Paxton *et al.* (1989). We recognise *Cnidoglanis nudiceps* as a valid species of *Euristhmus* and must, therefore, treat *Exilichthys* as a junior synonym of *Euristhmus*.

The objectives of this paper are to: elucidate characters that distinguish the genus *Euristhmus* from other marine plotosid genera; provide a key to species of *Euristhmus* and a description of each, including two species not previously recognised; and present information about the distribution of the species of *Euristhmus*.

METHODS AND MATERIAL

Measurements were made point-to-point with dial calipers and recorded to 0.1 mm. Head length (HL) was measured from the tip of the snout to the posteriormost extremity of the fleshy opercular flap; head width (HW) was the greatest width of the head; as both the pectoral- and pelvic-fins have a thick, fleshy covering with the fin-rays not visible, the length of each of these fins was the greatest straight-line distance from where the fin joined the body to the distal tip; preanal length (PL) was measured from the snout tip to the anterior basis of the anal fin; snout to first dorsal-fin origin was the length from the snout tip to the anterior basis of the first dorsal fin; interorbital width was the least distance between the orbits; opercle height was the straight-line vertical distance at the posterior edge of the opercle; nape height was the greatest straight-line vertical distance anterior to the first dorsal-fin origin; eye length was the greatest horizontal distance anterior to posterior; and vertebral counts, which are given as preanal (with open haemal arches) plus anal (with closed haemal arches) vertebrae. The number of specimens observed to have a particular count is given in parentheses immediately following that count. The count in the holotype or lectotype is underlined.

Counts of vertebrae and unpaired fin rays were made from radiographs. Counts of paired fins were made on both the right and left sides. The dorsal procurrent caudal-fin rays extend anteriorly to a point near the terminus of the first dorsal fin. The elongate rays in this fin are unbranched and are not associated with pterygiophores, but in outward appearance this fin looks like a second dorsal fin. For purposes of convenience, we are calling this the second dorsal fin. Based on radiographic images, it was evident that many of our specimens had sustained damage to, or lost, a portion of their caudal region, probably due to predation. In most of these specimens, the caudal region had regenerated or was in the process of regeneration and was often externally indistinguishable from that in an intact specimen. Because this situation was evident in more than just a few specimens, we did not attach any significance to counts of anal vertebrae or fin rays of median fins. For the same reason, proportional body measurements were not compared against standard length but were, instead, compared to preanal length (PL). When the range of a particular proportional body measurement is provided in the diagnosis of a species, the mean is also provided and represented by the Greek letter *mu* (μ). Specimen length is reported as total length (TL), in mm, throughout the paper.

Eschmeyer (1998) is followed for institutional codes.

TAXONOMY

Euristhmus Ogilby, 1899

Euristhmus Ogilby, 1899: 154. Type species: *Plotosus elongatus* Castelnau, 1878. Type by original designation. Gender: Masculine.

Exilichthys Whitley, 1933: 65. Type species: *Cnidoglanis nudiceps* Günther, 1880. Type by original designation. Gender: Masculine.

Description. *Euristhmus* comprises a group of eel-tailed catfishes with a broad, slightly depressed head and a long, tapering, compressed body. The second-dorsal and anal fins are confluent with the caudal fin, which is pointed at its terminus. The body has a complete lateral line that extends to the caudal fin.

The profile of the head from the snout to the first dorsal-fin origin is a smooth, posterodorsal slope. The head depth is greatest at a vertical with the posteriormost edge of the operculum. The snout margin is gently rounded from dorsal view. The lips are very fleshy; lower lip is continuous with the chin. The eye is dorsolateral in position and not visible from ventral view; eye small to moderate, its length is 0.10–0.27 of head length (Table 1). The interorbital width is greater than the eye length (interorbital width 0.21–0.35 of head length).

Four pairs of barbels are located in the mouth region: nasal, maxillary, and 2 pairs of mandibular barbels. The nasal barbels are positioned almost medially and are about one eye length dorsal to the anterior naris. The nasal barbels are separated from each other by a distance approximately equal to the eye length. The nasal barbel extends posteriorly at least as far as the posterior margin

of the orbit and sometimes onto the nape. The maxillary barbel extends posteriorly almost to, or beyond, the base of the pectoral-fin spine. The 2 pairs of mandibular barbels are in a transverse line just posterior to the lip of the lower jaw. The mandibular barbels extend posteriorly to about the posterior edge of the gill cover.

The anterior naris is located dorsal to the papillate portion of the upper lip; its opening is anteriorly-directed. The posterior naris is an elongate slit at the posterolateral base of the nasal barbel.

The branchiostegal membrane is supported by 6 or 7 rays on the anterior ceratohyal and 1 on the posterior ceratohyal. The branchiostegal membranes are cutaneously attached along ventral midline and narrowly attached to the isthmus. The gill opening is wide.

The mouth is subterminal with the upper jaw extending anteriorly slightly beyond the margin of the lower jaw. Upper jaw teeth are distributed in 2 ovoid tooth patches, 1 on each side of the symphysis. Five to 10 teeth occur in each tooth patch; teeth are conical and stout, with the medial teeth larger than the more laterally positioned teeth. Vomerine teeth are present in a medial crescentic or triangular patch; teeth are short, blunt, and stout, with the largest teeth along the midline. The teeth in the lower jaw are bluntly rounded, arranged in 2 or 3 rows medially and taper to 1 row laterally; teeth in the outer row are the largest on the jaw.

The first dorsal fin originates on a vertical line through, or just posterior to, the pectoral-fin base. The first dorsal fin consists of a spinelet or first spine, a second spine and 3–5 segmented rays. The spinelet is very short and closely applied to the base of the second spine (and thus easily overlooked). The second spine is tall and pungent with serrae on the anterior and posterior margins. The penultimate and ultimate soft rays are closely applied.

The second dorsal fin, which was described in Materials and Methods, has 72–136 fin rays (Table 2). The second dorsal-fin origin is anterior to, or on, a vertical line through the pelvic-fin origin.

The caudal fin tapers to a point, however, the tail region frequently exhibits signs of damage and subsequent regeneration. Caudal-fin rays are not easily distinguished from the confluent second dorsal- and anal-fin rays. The caudal fin has 5–19 rays on the hypural plate with numbers greater than 5 present on specimens that appear to have regenerated caudal regions. There are no ventral procurrent fin rays.

The anal-fin origin is located at about the anterior one-third of TL. The anal-fin base is shorter than that of the second dorsal fin, but rays of both fins are approximately the same height. Anal-fin rays are segmented and range in number from 67–117.

The distal margin of the pelvic fin is broadly convex with the middle rays longest. The pelvic-fin rays are segmented and all but the first ray are branched. The tip of the adpressed pelvic fin extends slightly past the anal-fin origin. The pelvic fin has 10–13 rays.

The pectoral-fin spine is well developed. The anterior surface of the pectoral-fin spine has distinct serrae; serrae are sometimes also present on the posterior surface. The anteriormost pectoral-fin rays are longest, and the posterior margin of the fin is convex. The pectoral fin has 8–11 branched rays. The axillary pore is single, large and horizontally elongate. In some mature males, the axillary area has a patch of rugose epidermis (Fig. 1) of unknown function that may obscure the axillary pore.

The vertebral column has 17–20 preanal and 52–108 anal vertebrae. The wide range in number of anal vertebrae (as well as anal and second dorsal-fin rays) is likely to be attributable to loss, probably due to predation, and subsequent regeneration of the tail region.

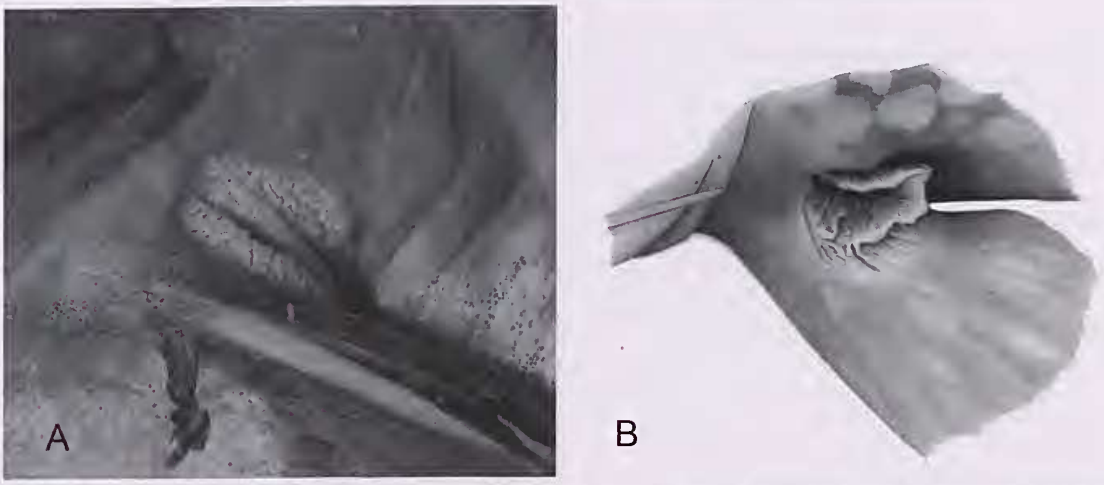

Fig. 1. A, lateral view of axillary region of the left pectoral fin in *Euristhmus microphthalmus* n. sp. (WAM P.29974-047). Image by Sandra J. Raredon; **B**, dorsolateral view of the axillary region of the left pectoral fin in *Euristhmus microceps*. Drawing by Janet R. Gomon, specimen not indicated.

Comparison with other marine plotosids. Amongst the four marine genera of the Plotosidae (*Cnidoglanis, Euristhmus, Paraplotosus* and *Plotosus*), *Cnidoglanis* and *Euristhmus* are the most elongate with the body depth at first dorsal-fin origin less than 12% of total length (vs. body deeper, body depth at the first dorsal-fin origin typically greater than 15% of total length in *Paraplotosus* and *Plotosus*).

Paraplotosus further differs from *Euristhmus* in having the following combination of characters: the anterior naris is situated within the folds of the upper lip and opens directly ventrally; the second dorsal-fin origin is immediately posterior to the posterior terminus of the first dorsal fin; and the gill membranes are joined broadly across the isthmus and attach to the isthmus anteriorly.

Plotosus further differs from *Euristhmus* in having the following combination of characters: the second dorsal-fin origin is posterior to a vertical line extending from the pelvic-fin origin; and the premaxillary tooth patch is elongate and extends laterally for most of the width of the mouth.

In the literature, *Euristhmus* has most commonly been confused with *Cnidoglanis*, but actually character differences between *Cnidoglanis* and *Euristhmus* are numerous: *Cnidoglanis* has a prominent lower lip fringe (*Euristhmus* has none); *Cnidoglanis* has a tapering head shape, more narrow anteriorly than posteriorly (*Euristhmus* is less tapered anteriorly); *Cnidoglanis* has a more horizontally-elongate eye (the eye of *Euristhmus* is more circular); *Euristhmus* has two prominent tooth patches with five to ten teeth each anteriorly in upper jaw (*Cnidoglanis* has two small tooth patches with fewer than five teeth); and *Euristhmus* has the mandibular barbels positioned along a straight line (in *Cnidoglanis* the more lateral barbels are posterior to the medial barbels).

Key to species of *Euristhmus*

1a. Rays of first dorsal fin elongate, with longest rays equal to, or greater than, head length; tip of adpressed first dorsal fin reaching almost to, or beyond, vertical line through anal-fin origin 2

1b. Rays of first dorsal fin not elongate, with longest rays less than head length; tip of adpressed first dorsal-fin terminating far short of vertical line through anal-fin origin 3

2a. Body coloration mottled; large dusky brown blotch located near lateral line ventral to base of first dorsal fin; head width 32% or greater of preanal length; branched pectoral-fin rays 9–11 ..... *Euristhmus microceps*

2b. Body coloration solid brown, gray, tan, or whitish; no large dusky brown blotch near lateral line ventral to base of first dorsal fin; head width 28% or less of preanal length; branched pectoral-fin rays 8 ..... *Euristhmus sandrae* n. sp.

3a. Abdomen speckled with tiny brown spots; dorsoposterior portion of cranium visible through skin; vomerine tooth patch broadly curved posteriorly and thin, only 2 to 3 teeth deep at midline ..... *Euristhmus nudiceps*

3b. Abdomen not speckled with tiny brown spots; dorsoposterior portion of cranium not visible through skin; vomerine tooth patch slightly curved or almost straight posteriorly, 4 or more teeth deep at midline 4

4a. Eye length 14–20% of head length (Fig 2A); eye length 6–10% of preanal length ..... *Euristhmus lepturus*

4b. Eye length 10–12% of head length (Fig. 2C); eye length 5–6% of preanal length ..... *Euristhmus microphthalmus* n. sp.

Euristhmus lepturus (Günther, 1864)

(Figs 2A, 3, 4A; Tables 1–2)

Cnidoglanis lepturus Günther, 1864: 28. Type locality: Sydney, New South Wales, Australia.

Plotosus elongatus Castelnau, 1878a: 237. Type locality: Brisbane River, Queensland, Australia.

Euristhmus lepturus. – Ogilby 1899: 155 (new combination).

Material examined. 52 specimens, 40–388 mm TL. AUSTRALIA, NEW SOUTH WALES: Sydney, BMNH 1864.1.17.33 (1, 333), lectotype of *Cnidoglanis lepturus*, designated herein, no stated locality, AMS I.31441-002 (1, 357), AMS IB.5511-5512 (2, 270–310); Rose Bay, 33°52'S, 151°16'E, AMS I.7579 (1, 388); Port Jackson, Sydney Harbour, AMS IB.641-643 (3, 142–235); Port Jackson, SU 20975 (1, 130); Bobbin Head, Kuringai Chase National Park, 33°39'S, 151°09'E, AMS I.30177-002 (1, 330), AMS I.30335-001 (1, 190), AMS I.30336-001 (1, 230) and AMS I.30353-001 (1, 255); Tea Gardens, 32°40'S, 152°10'E, AMS IB.4539, 4554 (2, 199–295); Clarence River, AMS I.19341-004 (3, 54–96); Parramatta River, 33°50'S, 151°05'E, AMS I.13033-13035 (3, 160–270); Hawkesbury River, AMS I.27073-001 (2, 160–250); Hawkesbury River, Gentleman's Halt, 33°28'S, 151°11'E, AMS I.19951-016 (1, 220); *ibid.*, ANSP 135468 (2, 92–119); *ibid.*, LACM 37501-2 (1, cleared and stained, 124); *ibid.*, USNM 219608 (4, 127–300); Hawkesbury River Bridge, 33°30'S, 151°10'E, AMS I.14628 (1, 330); Hunter River, Newcastle, 33°30'S, 151°47'E, AMS I.15886-002 (2, 251–252); Raleigh, Bellinger River, 30°27'S, 153°01'E, AMS IB.2314 (1, 365). QUEENSLAND: Moreton Bay, ANSP 122289 (1, 120); Moreton Bay, 27°15'S, 15°315'E, WAM P.28777-024 (8, 87–208); Serpentine Creek, Moreton Bay, AMS I.19574-007 (4, 89–105); Brisbane River, SU 20551 (1, 338); Norman, Karumba Point Beach, AMS I.22083-007

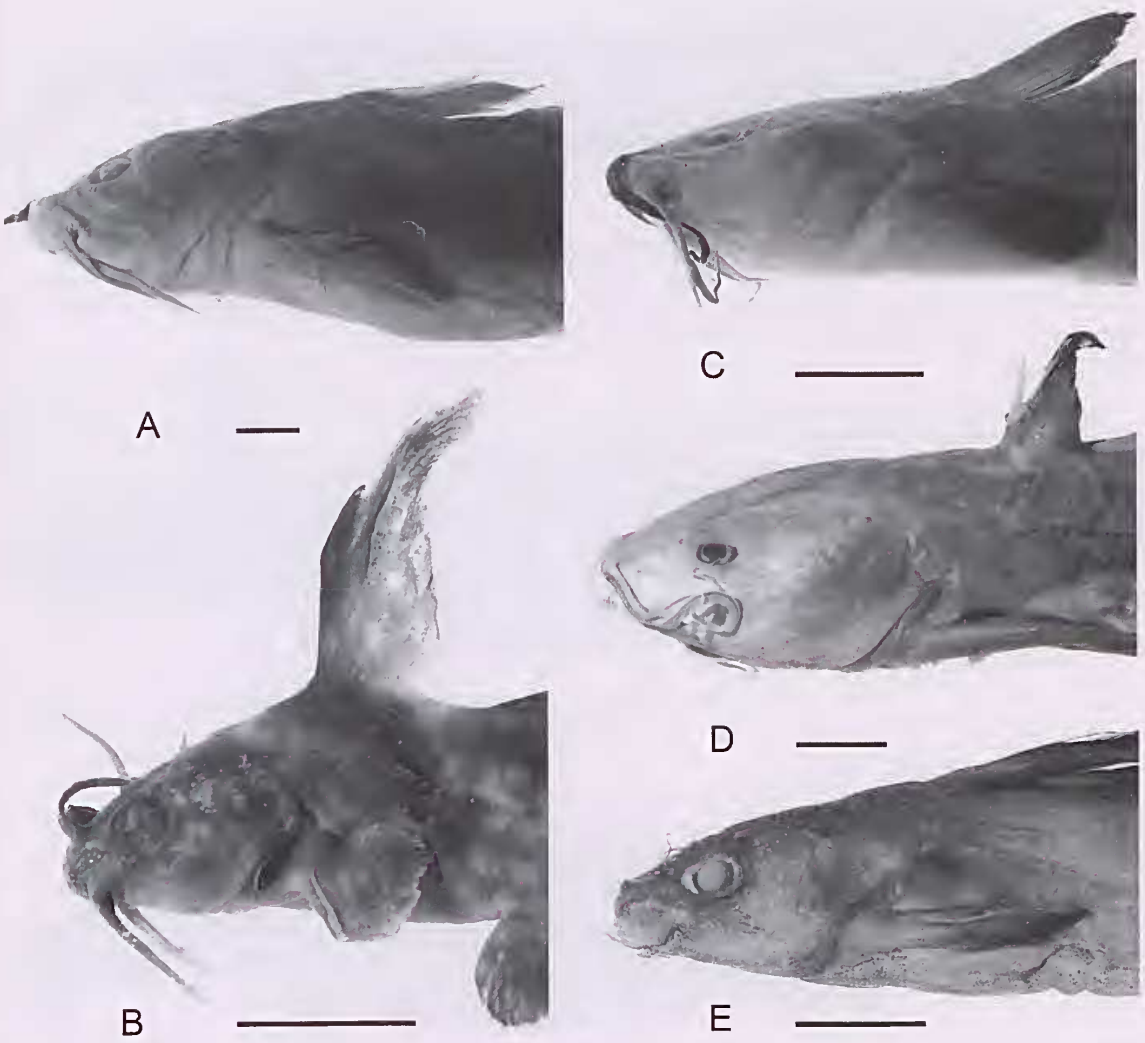

Fig. 2. Lateral view of head of *Euristhmus* species: **A**, *Euristhmus lepturus* (USNM 219608); **B**, *Euristhmus microceps* (WAM P.30081-001); **C**, *Euristhmus microphthalmus* n. sp. (AMS I.24689-012); **D**, *Euristhmus nudiceps* (AMS I.20771-081); **E**, *Euristhmus sandrae* n. sp. (WAM P.32730-001). Scale bar on each figure equals 1 cm. Images by Sandra J. Raredon.

(2, 40–42); Karumba, 17°29'S, 140°50'E, AMS I.26859-016 (1, 173).

Diagnosis. *Euristhmus lepturus* is distinguished from its congeners in having: the nasal barbel extending posteriorly as far as the nape; vomerine tooth patch slightly curved or almost straight posteriorly, 4 or more teeth deep at midline; eye length 14% of head length or greater (14–20%); and maxillary barbel extending posteriorly to pectoral-fin base. Among proportional measurements within the genus (Table 1), *E. lepturus* has the least ratio between body depth and head length (0.460–0.615, μ = 0.537), the greatest ratio between pectoral-fin length and preanal length (0.206–0.387, μ = 0.327), and the greatest ratio between head length and preanal length (0.446–0.537, μ = 0.496).

Description. As for genus except as indicated below.

First dorsal-fin rays: II,3(1), II,4(6), II,5(6). Second dorsal-fin rays: 95(1), 110(1), 111(1), 112(1), 113(1), 114(3), 116(1), 117(2), 118(1), 127(1). Anal-fin rays: 85(1), 97(1), 98(1), 100(1), 101(1), 102(2), 103(1), 105(2), 106(1), 109(2). Pectoral-fin rays: I,9(7), I,10(8), I,11(3). Pelvic-fin rays: 10(2), 11(5), 12(10). Preanal vertebrae: 18(3), 19(6), 20(4). Anal vertebrae: 58(1), 74(2), 75(2), 76(1), 77(4), 78(3).

Adpressed first dorsal fin reaches or slightly overlaps second dorsal fin, but in large specimens (>300 mm) adpressed first dorsal fin typically does not reach second

Fig. 3. *Euristhmus lepturus* from New South Wales, Australia (USNM 219608, 300 mm TL). Image by Sandra J. Raredon.

dorsal fin. Vomerine tooth patch large and deep, more than four teeth deep at midline. Second dorsal fin slightly taller than anal fin.

Coloration of preserved material. Head and body dusky brown to light brown. Nasal barbel dusky to black, more dusky or black than other barbels. Distal portions of first-dorsal, pectoral and pelvic fins black; second-dorsal and anal fins black distally; and anal fin darker than second dorsal fin.

Distribution. East coast and northern Australia, from Sydney, New South Wales to Karumba in the Gulf of Carpentaria (Fig. 4).

Remarks. Günther's (1864) original description of *Cnidoglanis lepturus* indicated that he examined two specimens: a 14 inch-long specimen from Sydney and a 13 inch-long stuffed specimen that was stated to have originated only from Australia. Günther's description was based primarily on the Sydney specimen (BMNH 1864.1.17.33); hence we designate this specimen as the lectotype.

Fig. 4. Distribution map for species of *Euristhmus*: *E. lepturus* (A), *E. microceps* (B), *E. microphthalmus* n. sp. (C), *E. nudiceps* (D), and *E. sandrae* n. sp. (E). Symbols are only approximate locations and may represent more than one specimen.

***Euristhmus microceps* (Richardson, 1845)**

(Figs 1B, 2B, 4–6; Tables 1–2)

Plotosus microceps Richardson, 1845: 31, pl. 21, figs 4–7 (north-west coast of Australia).

Cnidoglanis microcephalus Günther, 1864: 28 (unnecessary replacement name for *Plotosus microceps* Richardson, 1845).

Cnidoglanis microceps. – Taylor 1964: 86 (new combination).

Euristhmus microceps. – Paxton *et al.* 1989: 223 (new combination).

Material examined. 12 specimens, 96–243 mm TL. AUSTRALIA, north-west coast, BMNH 1846.3.3.2 (1, 226), holotype of *Plotosus microceps* and *Cnidoglanis microcephalus*. WESTERN AUSTRALIA: Broome, AMS IA.5112 (1, 185); north side of Coughs Bar, Shark Bay, 25°25'S, 113°35'E, WAM P.30258-003 (1, 166); Shark Bay, 25°21'S, 113°44'E, WAM P.14779-001 (1, 209); Shark Bay, 25°21'S, 113°44'E, WAM P.8504-001 (1, 148); Shark Bay, 25°21'S, 113°44'E, 38.3 m, WAM P.9094-001 (1, cleared and stained); Shark Bay, Cape Peron North, 6.23 km east of cape, 25°30.484'S, 113°33.688'E

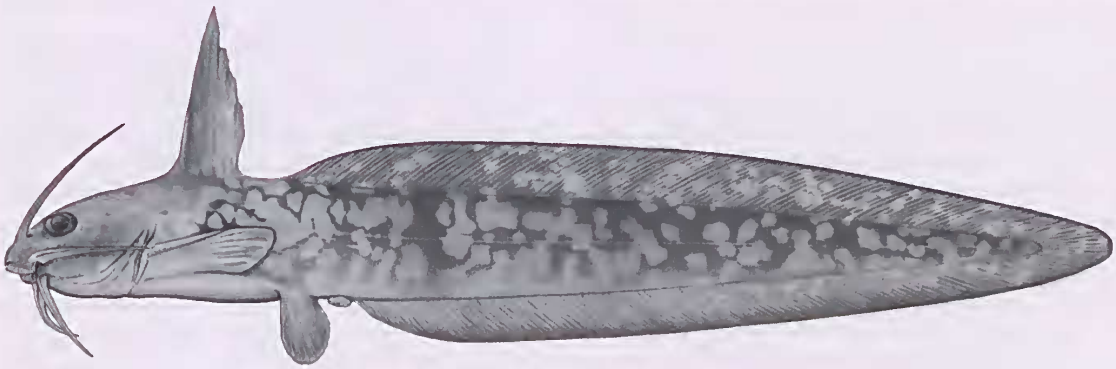

Fig. 5. *Euristhmus microceps*. Drawing by Janet R. Gomon, specimen not indicated.

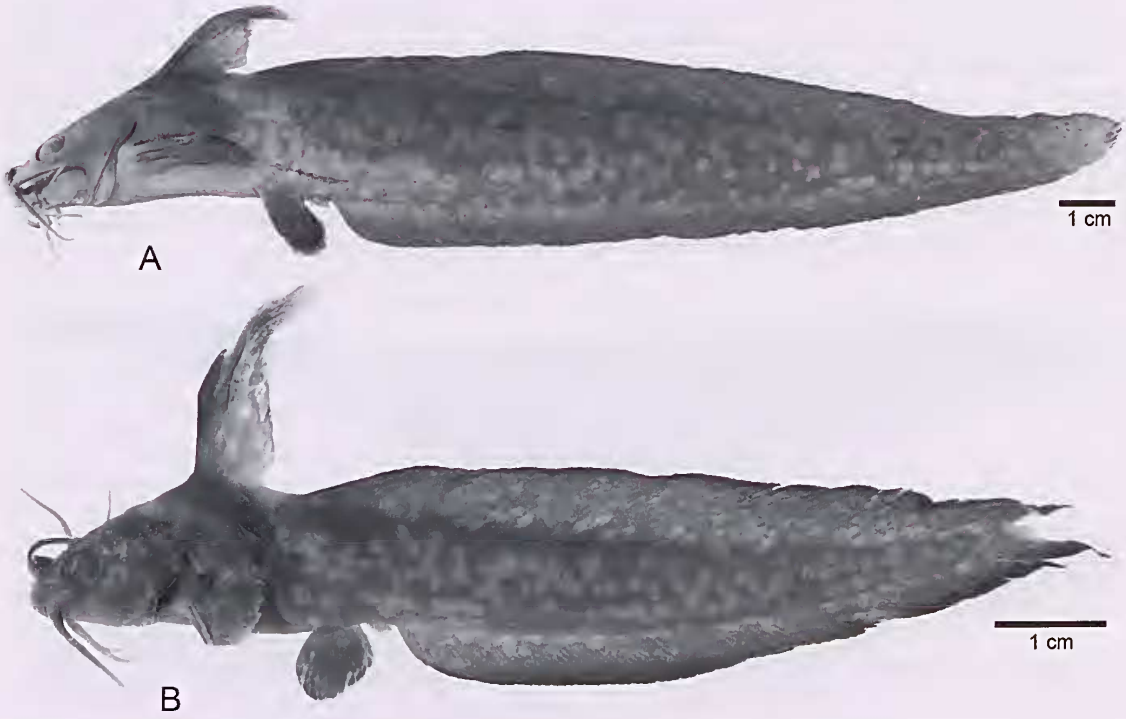

Fig. 6. A, *Euristhmus microceps* from Shark Bay, Western Australia, Australia (WAM P.30166-017, 209 mm TL); **B**, *Euristhmus microceps* from Shark Bay, Western Australia, Australia (WAM P.30081-001, 96 mm TL). Images by Sandra J. Raredon.

to 25°31.030'S, 113°32.6245'E, WAM P.32381-001 (1, 243); Shark Bay, Cape Peron North, 25°30'S, 113°33'E, 13 m, WAM P.32477-001 (1, 243); Shark Bay, 25°56'S, 113°32'E, 0.5–2.5 m, WAM P.30166-017 (1, 209); Shark Bay, 26°09'S, 113°13'E, 1.0–1.5 m, WAM P.30081-001 (1, 96); Cape Lesueur, 47.62 km west of cape, 25°36.736'S, 113°14.478'E, WAM P.32439-002 (1, 192). NORTHERN TERRITORY: North of Goulburn Islands, 60 m, NTM S.11897-017 (1, 96).

Diagnosis. *Euristhmus microceps* is distinguished from its congeners by the combination of its elongate first dorsal fin that is equal to or greater than head length, and its mottled body coloration. The adpressed first dorsal-fin tip of *E. microceps* reaches almost to a vertical line through the anal-fin origin (vs. adpressed first dorsal-fin tip not approaching a vertical line through the anal-fin origin in all other *Euristhmus* species except for *E. sandrae* n.sp.). The coloration of the body is mottled (vs. body coloration solid brown, gray, tan, or whitish in all congeners). *Euristhmus microceps* is the only species in the genus for which no specimen examined had more than 99 anal-fin rays (67–99 vs.77–117 in congeners) and second-dorsal fin rays not exceeding 107 (72–107 vs.79–136 in congeners). For proportional measurements within the genus (Table 1), *E. microceps* has the greatest ratio between body depth and head length (0.552–0.859, μ = 0.691), the greatest ratio between pelvic-fin length and head length (0.428–0.537, μ = 0.497), and the greatest ratio between pelvic-fin length and preanal length (0.191–0.264, μ = 0.230). First dorsal fin is proportionally longer in juveniles than in adults.

Description. As for genus, except as indicated below.

First dorsal-fin rays: I1,3(2), I1,4(3), I1,5(5). Second dorsal-fin rays: 72(1), 83(1), 96(1), 100(3), 102(1), 103(2), 107(1). Anal-fin rays: 67(1), 79(1), 80(1), 85(1), 86(1), 87(1), 90(1), 93(1), 99(2). Pectoral-fin rays: I,9(3), I,10(5), I,11(5). Pelvic-fin rays: I1(3), I2(7), I3(6). Preanal vertebrae: 18(4), 19(4), 20(1). Anal vertebrae: 52(1), 61(1), 62(1), 65(1), 67(1), 68(2), 78(1), 80(1).

In the holotype and in two other specimens (WAM P.30258-003 and WAM P.32381.001), numerous raised neuromasts are visible on the head. Jaw teeth are larger and more numerous than in congeners. Nasal barbels of the holotype and a second specimen (WAM P.30258-003) are very long, extending to the base of the first dorsal fin.

Coloration of preserved material. Head and body mottled with large white spots. Large dusky brown spot near lateral line ventral to base of first dorsal fin. Anal fin and second dorsal fin with black distal margin. Filamentous first dorsal-fin ray black.

Distribution. Shark Bay, Western Australia, to Goulburn Islands, Northern Territory, in nearshore habitats as deep as 60 m over soft bottoms (Fig. 4).

Remarks. The venter of the holotype has been sutured. This is likely the result of the examination of the gut mentioned in the original description (Richardson 1845).

Euristhmus microphthalmus new species

(Figs 1A, 2C, 4, 7; Tables 1–2)

Type material. HOLOTYPE – AUSTRALIA, NORTHERN TERRITORY: Woods Inlet, Darwin Harbour, 12°30'S, 130°45'E, coll. H. Larson and R. Williams, 16 March 1984, NTM S.11242-001 (1, 367). PARATYPES (15, 81–283) – AUSTRALIA, NORTHERN TERRITORY: Beagle Gulf, mouth of Buffalo Creek, 0–1 m, coll. D. Rennis and R. Williams, 10 August 1983, AMS I.23944-002 (2, 204–235); Beagle Gulf, mouth of Buffalo Creek, coll. S. Reader, D. Beechy and R. Williams, 13 September 1984, AMS I.24689-012 (2, 164–258); mouth of East Alligator River, 0–2 m, 12°05.39'S, 132°32.1'E, coll. H. Larson and party, 2 June 1997, NTM S.14456-010 (5, 81–150); Woods Inlet, Darwin Harbour, same data as holotype, NTM S.11242-040 (2, 252–270). INDONESIA, WEST PAPUA: Bintuni, 0–1 m, coll. G.R.

Fig. 7. A, *Euristhmus microphthalmus* (holotype) from Northern Territory, Australia (NTM S.11242-001, 367 mm TL); **B,** *Euristhmus microphthalmus* (paratype) from Northern Territory, Australia (AMS I.24689-012, 164 mm TL). Images by Sandra J. Raredon.

Allen, 22 Mareh 1989, 02°07'S, 133°31'E, WAM P.29959-003 (1, 270); Bintuni Bay, 02°20'S, 133°25'E, eoll. G.R. Allen, 6 April 1989, WAM P.29974-047 (1, 201); Bintuni Bay, eoll. S. Viada, 5 February 2001, UF 11756 (1, 169); Bintuni Bay, 25–35 m, eoll. S. Viada, 5 February 2001, UF 11762 (1, 283).

Non-type material. 9 speeimens, 127–365 mm TL. AUSTRALIA, NORTHERN TERRITORY: South of Cape Shield, north of Groote Eylandt, 13°24'S, 136°20'E, NTM S.10943-009 (1, 355); mangrove ereek at mouth of Towns River, 14°54.89'S, 135°25.82'E, NTM S.14042-030 (1, 290); east side of East Alligator River mouth, 12°05.68'S, 132°38.29'E, NTM S.14656-011 (1, 128); south of Orontes Reef, Cobourg Peninsula, 11°06'S, 132°04'E, NTM S.12445-035 (1, 305); east end Poeoek's Beaeh, West Alligator Head, 12°11.33'S, 132°13.30'E, NTM S.14424-008 (1, 345); seaward off Buffalo Creek, Shoal Bay, 12°21'S, 130°55'E, NTM S.12488-001 (1, 127); Mieket Creek, 0–1 m, 12°21'S, 130°57'E, AMS I.23941-028 (1, 139); Woods Inlet, Darwin Harbour, 12°30'S, 130°45'E, NTM S.13019-001 (1, 177); Joseph Bonaparte Gulf, 14°12.79'S, 128°41.27'E, NTM S.14355-023 (1, 365).

Diagnosis. *Euristhmus microphthalmus* is distinguished from its congeners in having a small eye, whose length is less than 13% of head length (0.095–0.124, μ = 0.113). For other proportional measurements within the genus (Table 1), *E. microphthalmus* has the greatest ratio between head width and head length (0.706–0.868, μ = 0.771) and the least ratio between eye length and preanal length (0.046–0.063, μ = 0.053).

Description. As for genus, exeept as indieated below.

First dorsal-fin rays: I1,4(6), I1,5(4). Seeond dorsal-fin rays: 79(1), 93(1), 95(1), 112(1), 114(1), 117(1), 123(1), 127(2), 129(1), 136(1). Anal-fin rays: 83(1), 85(1), 93(1), 101(1), 102(1), 103(1), 106(1), 108(1), 112(1), 116(1), 117(1). Peetoral-fin rays: I,9(5), I,10(5), I,11(2). Pelvie-fin rays: 10(1), 11(5), 12(10). Preanal vertebrae: 17(1), 18(3), 19(7). Anal vertebrae: 37(1), 49(1), 61(1), 64(1), 65(1), 70(1), 71(1), 78(2), 80(1), 108(1).

Vomerine tooth patch large and deep, 4–6 teeth deep at midline. Nasal barbel long, reaching to nape and sometimes beyond first dorsal-fin origin. Leading edge of peetoral fin gently eurved. Seeond dorsal-fin origin not eontiguous with base of first dorsal fin; adpressed first dorsal fin sometimes not reaching seeond dorsal fin. Distanee from peetoral-fin terminus to pelvie-fin origin sometimes as great as pelvie-fin length. Axillary area very fleshy and whitish in males.

Coloration of preserved material. Nasal barbel more blaekish than other mouth barbels. Head and body dusky grey, dusky brown, or tan. Venter whitish. Peetoral fin dusky or blaekish. Pelvie fin less darkly pigmented than peetoral fin. Median fins dusky to blaekish, more dusky or blaekish posteriorly and distally.

Distribution. Northern Territory, Australia and West Papua, in nearshore habitats over soft bottoms (Fig. 4).

Etymology. The name, *microphthalmus*, is from the Greek *micro*, small, and *ophthalmus*, eye, in referenee to the small eye of this speeies in eomparison to its eongeners.

Remarks. Hardenberg (1941) reported *Cnidoglanis nudiceps* from Merauke, West Papua, Indonesia, and mentioned that his speeimens had a "mueh smaller eye" than the type speeimen. Although we did not examine Hardenberg's speeimens or any speeimens from Merauke, we speeulate that Hardenberg's speeimens were eonspeeifie with the new speeies deseribed here, based on the reported small size of the eye and the distribution of the speeies.

Euristhmus nudiceps (Günther, 1880)

(Figs 2D, 4, 8, 9; Tables 1–2)

Cnidoglanis nudiceps Günther, 1880: 49 (Arafura Sea).

Exilichthys nudiceps. – Whitley 1933: 65 (new eombination).

Euristhmus nudiceps. – Gloerfelt-Tarp and Kailola 1984: 69 (new eombination).

Material examined. 92 speeimens, 102–340 mm TL. AUSTRALIA, QUEENSLAND: Gulf of Carpentaria, 16°48'S, 139°30'E, AMS I.15557-039 (2, 172–183); near Torres Strait, Cape York, 11°37'S, 142°56'E, 16–18 m, AMS I.20771-081 (8, 184–309); Lindeman Island, 20°27'S, 149°03'E, AMS IA.6731-2 (3, 261–280); 6 km E of North East Point, Port Clinton entranee, 22°28.17'S, 150°48.44'E, AMS I.34364-008 (3, 170–265); Townsville, ANSP 122318 (1, 221). NORTHERN TERRITORY: Arafura Sea, BMNH 1879.5.14.590 (1, 232), holotype of *Cnidoglanis nudiceps;* north of Cape Wessel, Arafura Sea, 09°56'S, 136°55'E, NTM S.12069-003 (1, 248); north of Arnhem Land, Arafura Sea, 84 m, 10°02'S, 133°58'E, AMS I.21847-008 (4, 218–338); north-east of Goulburn Islands, Arafura Sea, 10°21'S, 134°23'E, NTM S.12263-002 (1, 280); north

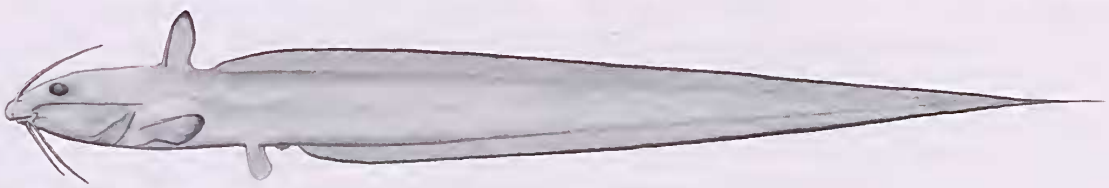

Fig. 8. *Euristhmus nudiceps.* Drawing by Janet R. Gomon, speeimen not indieated.

Fig. 9. *Euristhmus nudiceps* from Western Australia, Australia (AMS I.20771-081, 309 mm TL). Image by Sandra J. Raredon.

of Goulburn Islands, Arafura Sea, 10°17'S, 133°35'E, NTM S.12268-006 (2, 153–270); Melville Island, 10°51'S, 130°43'E, NTM S.331-001 (1, 248); *ibid.*, NTM S.332-001 (1, 250); *ibid.*, NTM S.333-001 (1, 265); *ibid.*, NTM S.334-001 (1, 248); *ibid.*, NTM S.335-001 (1, 267); *ibid.*, NTM S.432-001 (1, 210); *ibid.*, NTM S.433-001 (1, 177); ibid., NTM S.434-001 (1, 248); *ibid.*, NTM S.435-001 (1, 245); *ibid.*, NTM S.436-001 (1, 225); *ibid.*, NTM S.437-001 (1, 194); *ibid.*, NTM S.438-001 (1, 255); 6 km north of Jones Shoal, Cobourg Peninsula, 10°53'S, 132°17'E, NTM S.614-001 (1, 226); *ibid.*, NTM S.616-001 (1, 210); *ibid.*, NTM S.618-001 (1, 270); *ibid.*, NTM S.588-001 (1, 230); *ibid.*, NTM S.589-001 (1, 140); *ibid.*, NTM S.590-001 (1, 265); *ibid.*, NTM S.591-001 (1, 271); *ibid.*, NTM S.446-001 (1, 235); north of Smith Point, Cobourg Peninsula, 10°58'S, 132°10'E, NTM S.10031-039 (8, 102–340); north of Arnhem Land, Arafura Sea, 11°01'S, 132°03'E, 32–33 m, AMS I.21830-018 (1, 303); west of Orontes Reef, Cobourg Peninsula, 11°04'S, 132°06'E, NTM S.12434-038 (1, 136); *ibid.*, NTM S.12536-033 (4, 200–275); *ibid*, NTM S.12445-034 (1, 255); NE of Point Charles, Beagle Gulf, 12°14.64'S, 130°41.46'E, NTM S.13283-019 (1, 181); Shoal Bay, 12°18'S, 130°58'E, NTM S.12490-001 (1, 147); off Lee Point, Shoal Bay, 12°19'S, 130°54'E, NTM S.12487-001 (2, 182–182); north of Bowra Shoals, Fog Bay, 12°42'S, 130°11'E, NTM S.13001-003 (1, 185); Joseph Bonaparte Gulf, Timor Sea, 14°05'S, 129°05'E, NTM S.13378-013 (5, 150–220). WESTERN AUSTRALIA: Joseph Bonaparte Gulf, 13°43'S, 128°38'E, WAM P.25712-001 (7, 137–225); Joseph Bonaparte Gulf, 14°31.51'S, 128°52.13'E, NTM S.14353-009 (3, 118–191); Bonaparte Archipelago, Admiralty Gulf, 14°00'S, 124°25'E, 60 m, AMS I.20402-039 (1, 317); York Sound, NTM S.26-001 (1, 192); (?) Hampton Harbour, AMS IB.3093 (1, damaged); Exmouth Gulf, 22°S, 114°E, AMS IB.3004 (1, 156); Exmouth Gulf, 22°05'S, 114°15'E, AMS I.33311-001 (4, 183–247); Exmouth Gulf, Badjirrajirra Creek, 22°07'S, 114°12'E, WAM P.32621.008 (3, 181–213).

Diagnosis. *Euristhmus nudiceps* is distinguished from its congeners in having the dorsoposterior portion of the cranium visible through the skin, and the vomerine tooth patch broadly curved posteriorly and thin being only 2 or 3 teeth deep in the midline. In addition, the abdomen is speckled with tiny brown spots. For proportional measurements within the genus (Table 1), *E. nudiceps* has the least ratio between pelvic-fin length and head length (0.225–0.393, $\mu = 0.321$), the least ratio between nape height and head length (0.529–0.641, $\mu = 0.592$), the least ratio between pectoral-fin length and head length (0.442–0.669, $\mu = 0.548$), the least ratio between pectoral-fin length and preanal length (0.210–0.333, $\mu = 0.268$) and the least ratio between pelvic-fin length and preanal length (0.109–0.196, $\mu = 0.156$).

Description. As for genus, except as indicated below.

First dorsal-fin rays: II,3(2), II,4(8). Second dorsal-fin rays: 89(1), 95(1), 97(1), 99(1), 112(1), 115(1), 116(1), 117(1), 119(2). Anal-fin rays: 77(1), 87(2), 88(1), 92(1), 99(1), 103(1), 106(1), 109(1), 111(1). Pectoral-fin rays: I,8(1), I,9(3), I,10(3), I,11(2). Pelvic-fin rays: 10(1), 11(2), 12(5). Preanal vertebrae: 18(4), 19(5), 20(1). Anal vertebrae: 43(1), 53(1), 55(1), 56(1), 66(1), 75(1), 77(2), 79(1), 81(1).

Distance from terminus of pectoral fin to pelvic-fin origin greater than pelvic-fin length. Second dorsal-fin origin not contiguous with posterior base of first dorsal fin. Adpressed first dorsal-fin margin does not reach, or just barely overlaps second dorsal fin. Nasal barbels typically shorter than in congeners, barbels extend posteriorly only to nape.

Coloration of preserved material. Head and body tannish to light brown. Second-dorsal, anal, and caudal fins distally black for their entire length. First-dorsal and pectoral fins distally blackened. Abdomen speckled with microscopic brown dots.

Distribution. Exmouth Bay, Western Australia, to Moreton Bay, Queensland, Australia, in nearshore habitats as deep as 84 m over soft bottoms (Fig. 4).

Remarks. Paxton *et al.* (1989) list BMNH 1879.5.14.590 as the holotype for *Cnidoglanis nudiceps*. The Natural History Museum in London lists a second specimen (BMNH 1890.2.26.165) taken during the *Challenger* expedition from the Arafura Sea that may also have been examined by Günther, although there is no evidence in the original description that more than one specimen was examined.

Table 1. Ranges and means of selected morphometric measures of *Euristhmus*. Head length and preanal length are abbreviated as HL and PL, respectively.

Morphometric measure	*E. lepturus*			*E. microceps*			*E. microphthalmus* n. sp.			*E. nudiceps*			*E. sandrae* n. sp.		
	n	mean	range	n	mean	range	n	mean	range	n	mean	range	n	mean	range
Pelvic–fin length/HL	10	0.402	0.325–0.482	9	0.497	0.428–0.537	12	0.463	0.382–0.558	10	0.321	0.225–0.393	2	0.453	0.406–0.500
Pectoral–fin length/HL	20	0.655	0.461–0.807	17	0.671	0.553–0.829	22	0.658	0.542–0.762	17	0.548	0.442–0.669	4	0.699	0.605–0.832
Preanal length/HL	10	1.951	1.862–2.240	9	2.177	1.974–2.425	12	2.163	1.920–2.440	10	2.058	1.933–2.211	2	2.461	2.341–2.580
Head width/HL	10	0.705	0.642–0.756	9	0.754	0.686–0.799	12	0.771	0.706–0.868	10	0.654	0.584–0.739	2	0.666	0.601–0.731
Snout – D1 origin/HL	10	1.123	0.948–1.240	9	1.135	1.110–1.193	12	1.130	0.983–1.190	10	1.129	1.067–1.194	2	1.200	1.150–1.250
Interorbital width/HL	10	0.290	0.244–0.339	9	0.278	0.256–0.292	12	0.264	0.231–0.339	10	0.246	0.214–0.279	2	0.247	0.214–0.279
Nape height/HL	10	0.653	0.560–0.733	9	0.701	0.565–0.795	12	0.657	0.589–0.768	10	0.592	0.529–0.641	2	0.636	0.613–0.659
Body depth/HL	10	0.537	0.460–0.615	9	0.691	0.552–0.859	12	0.638	0.522–0.806	10	0.550	0.482–0.603	2	0.680	0.653–0.707
Opercle height/HL	10	0.583	0.512–0.706	9	0.616	0.540–0.703	12	0.594	0.526–0.677	10	0.552	0.503–0.629	2	0.564	0.546–0.582
Eye length/HL	10	0.162	0.135–0.195	9	0.209	0.191–0.242	12	0.113	0.095–0.124	10	0.157	0.124–0.187	2	0.248	0.226–0.269
Head length/PL	10	0.496	0.446–0.537	9	0.461	0.412–0.507	12	0.465	0.409–0.522	10	0.487	0.452–0.517	2	0.408	0.388–0.427
Pelvic–fin length/PL	10	0.218	0.145–0.392	9	0.230	0.191–0.264	12	0.215	0.175–0.288	10	0.156	0.109–0.196	2	0.186	0.157–0.214
Pectoral–fin length/PL	20	0.327	0.206–0.387	17	0.308	0.252–0.391	22	0.305	0.264–0.363	17	0.268	0.210–0.333	4	0.287	0.235–0.355
Head width/PL	10	0.350	0.303–0.383	9	0.348	0.316–0.390	12	0.358	0.323–0.397	10	0.319	0.272–0.363	2	0.270	0.257–0.283
Snout – D1 length/PL	10	0.557	0.507–0.621	9	0.524	0.459–0.591	12	0.525	0.470–0.586	10	0.550	0.482–0.606	2	0.489	0.486–0.491
Interorbital length/PL	10	0.143	0.128–0.156	9	0.129	0.108–0.146	12	0.123	0.103–0.162	10	0.131	0.108–0.239	2	0.101	0.083–0.119
Nape height/PL	10	0.324	0.250–0.368	9	0.325	0.243–0.396	12	0.304	0.277–0.344	10	0.289	0.268–0.321	2	0.259	0.237–0.281
Body depth/PL	10	0.265	0.246–0.303	9	0.318	0.239–0.389	12	0.295	0.250–0.331	10	0.267	0.236–0.292	2	0.278	0.253–0.302
Opercle height/PL	10	0.289	0.238–0.328	9	0.285	0.234–0.327	12	0.275	0.233–0.310	10	0.269	0.238–0.313	2	0.230	0.212–0.248
Eye length/PL	10	0.081	0.060–0.102	9	0.096	0.084–0.121	12	0.053	0.046–0.063	10	0.076	0.062–0.089	2	0.101	0.097–0.104

Table 2. Selected meristic counts or ranges for species of *Euristhmus*. Count or range in holotype or lectotype is underlined.

	Second dorsal-fin rays												
	72–79	80–84	85–89	90–94	95–99	100–104	105–109	110–114	115–119	120–124	125–129	130–135	136–140
E. lepturus					1			7	4		1		
E. microceps	1	1			1	6	1						
E. microphthalmus n. sp.	1			1	1			2	1	1	3		1
E. nudiceps			1		3			1	5				
E. sandrae n. sp.						1		1					

	Anal-fin rays									First dorsal-fin rays		
	67–79	80–84	85–89	90–94	95–99	100–104	105–109	110–114	115–119	II,3	II,4	II,5
E. lepturus			1		2	5	5			1	6	6
E. microceps	2	1	3	2	2					2	3	5
E. microphthalmus n. sp.		1	1	1		3	2	1	2		6	4
E. nudiceps	1		3	1	1	1	2	1		2	8	
E. sandrae n. sp.						1		1			2	

	Anal vertebrae													
	35–40	41–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–95	96–99	100–104	105–108
E. lepturus					1			2	10						
E. microceps				1		2	4		1	1					
E. microphthalmus n. sp.	1		1			2	1	2	2	1					1
E. nudiceps		1		1	2		1		4	1					
E. sandrae n. sp.									2						

	Preanal vertebrae				Pectoral-fin rays				Pelvic-fin rays			
	17	18	19	20	1,8	I,9	I,10	I,11	10	11	12	13
E. lepturus		3	6	4		7	8	3	2	5	10	
E. microceps		4	4	1		3	5	5		3	7	6
E. microphthalmus n. sp.	1	3	7			5	5	2	1	5	10	
E. nudiceps		4	5	1	1	3	3	2	1	2	5	
E. sandrae n. sp.			1	1	2						1	

At the time of our examination of the holotype, the pelvic and pectoral fins were missing and only the base of the first dorsal fin was present.

Euristhmus sandrae new species

(Figs 2E, 4, 10; Tables 1–2)

Type material. HOLOTYPE – AUSTRALIA, WESTERN AUSTRALIA: Exmouth Gulf, 21°42'S, 114°48'E, 9 m, coll. S. M. Morrison, 3 November 2004, WAM P.32730.001 (1, 148). PARATYPE – AUSTRALIA, WESTERN AUSTRALIA: south of Rowley Shoals, Northwest Shelf, 18°12'S, 118°41'E, 76–80 m, coll. B. Russell and Northern Territory Observers team, 1 June 1985, NTM S.11673-030 (1, 217).

Diagnosis. *Euristhmus sandrae* is distinguished from its congeners in having a whitish tan body coloration and an elongate first dorsal fin that is greater than head length and reaches to, or beyond, a vertical line with the anal-fin origin. All fins are violet-black. This species differs from all examined congeners (except for one specimen of *E. nudiceps*) in having only 8 branched pectoral-fin rays. For proportional measurements within the genus (Table 1), *E. sandrae* has the greatest ratio between preanal length and head length 2.34–2.58, $\mu = 2.46$), the greatest ratio between eye length and head length (0.226–0.269, $\mu = 0.248$), and the least ratio between snout to first-dorsal fin origin and preanal length (0.486–0.491, $\mu = 0.489$). [As more specimens of this species are examined and measured, the above ratios may change significantly].

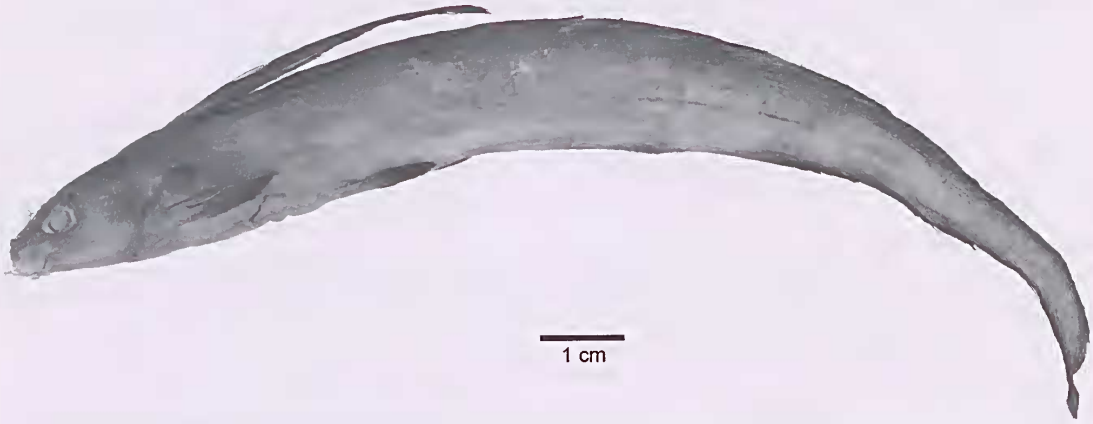

Fig. 10. *Euristhmus sandrae* n. sp. (holotype) from Western Australia, Australia (WAM P.32730-001, 148 mm TL). Image by Sandra J. Raredon.

Description. As for genus, except as indicated below.

First dorsal-fin rays: II,4(2). Second dorsal-fin rays 102(1), 114(1). Anal-fin rays: 100(1), 111(1). Pectoral-fin rays: 1,8(2). Pelvic-fin rays: 12(1). Preanal vertebrae: 19(1), 20(1). Anal vertebrae: 76(1), 78(1). [As the pectoral and pelvic-fin rays of the holotype cannot be counted without cutting and damaging the specimen, counts for these fins were not reported].

Vomerine tooth patch crescentic, only two rows of teeth in midline. Nasal barbel reaching almost to nape. Maxillary barbel not reaching opercle in holotype but extending to middle of operculum in paratype.

Coloration of preserved material. Nasal barbel more blackish than other mouth barbels, which are whitish. Head and body whitish tan, without mottling. Dusky area located dorsal to pectoral fin. Tiny, dusky speckles on body. Slightly larger dusky speckles ventrally on body and covering isthmus. All fins violet-black.

Etymology. The name, *sandrae*, honours Sandra J. Raredon of the National Museum of Natural History, Smithsonian Institution, U.S.A., who contributed greatly to this study and others undertaken by the authors.

Distribution. Western Australia, from south of Rowley Shoals and Exmouth Gulf, in waters as deep as 80 m over soft bottoms (Fig. 4).

ACKNOWLEDGMENTS

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